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## (54) FORK-LIFT TRUCK


(71) We, KOOI B.V. of 25 Molen, Vrouwenparochie, The Netherlands, a private limited liability company organized under the laws of The Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: :—


This invention relates to a fork-lift truck having its own drive mechanism, comprising a frame provided with wheels, a mast disposed on said frame and adapted to tip forwardly and rearwardly, means for tipping the mast, a fork adapted to move up and down along the mast, and means for moving the fork up and down. The object of the invention is to provide a fork-lift truck of this kind which is particularly suitable for combining with a lorry for loading said lorry and then being transported on the lorry.

According to the invention, the mast together with the fork can be moved laterally (transversely of the normal direction of travel of the fork-lift truck) over a distance of at least half the width of the fork, and means are provided to produce the lateral movement, said means allowing the tipping movement of the mast, said means for tipping the mast engaging the frame via an element displaceable laterally with respect to the frame. With a construction of this kind, the lift-truck can be of very compact construction behind the fork in the direction of travel, it being possible to dispose the front wheels level with the front edge of the fork. As a result of the laterally displaceable mast, a load can be placed on the load surface even at the site of the wheels of the lorry which is required to be loaded. The centre of gravity of the load can always remain within the points of support of the wheels in these conditions.

According to a preferred aspect of the invention, a bearing for the tipping mast can be formed by a tubular part which is connected to the frame, a shaft being mounted in said tubular part and being slidable and rotatable therein and is provided with one or more plate-like elements extending outwardly through the slot and bearing the mast.

The means for displacing the mast laterally can be formed by a control cylinder one end of which is connected to the frame and the other end to the mast, said cylinder extending substantially parallel to and at a slight distance from the tipping bearing and mounted so as to accommodate the tipping movement. With a construction of this kind, the control means have the minimum possible dimensions in the direction of travel, a considerable travel being possible in these conditons.

According to a preferred aspect of the invention, the tipping means can comprise a control cylinder one end of which is connected to the mast and the other end of which is connected to one arm of a toggle lever pivotally connected to the mast, the other arm of the toggle lever being pivotally connected to a slide movable in a guide forming part of the frame. In these conditions, the control cylinder may be situated practically in the plane of the mast so that here again the minimum amount of space is occupied in the direction of travel. As a result of the toggle lever a movement component is obtained in the required direction.

In one advantageous embodiment according to the invention, the slide is guided via one or more rollers in a transversely extending section which forms a hollow rail and which is secured to the frame. With a construction of this kind the tipping of the mast is not influenced in the event of a lateral displacement of the mast.

According to a preferred aspect of the invention, the frame girders bearing front wheels may be provided with a stop extending upwardly, the fork striking against said stop on lateral movement of the mast when the fork threatens to come into contact with either of the wheels. The effect of this is that no damage can occur in the event of incorrect operation of the means for lateral displacement of the mast.

In one advantageous embodiment, the stops may have top end faces which are in-

clined obliquely downwards to engage the fork on either a lateral or a downward displacement. Consequently, any impacts are taken more satisfactorily.

The invention will be explained in detail in the following description of one exemplified embodiment with reference to the drawings wherein:

Fig. 1 is a side elevation and partial section of a lift-truck according to the invention,

Fig. 2 is a top plan view of the lift-truck from fig. 1,

Fig. 3 shows the lift-truck according to figs. 1 and 2 in perspective, part having been omitted,

Fig. 4 is a perspective view of a detail of fig. 3,

Fig. 5 is a detail of fig. 1 to an enlarged scale,

Fig. 6 shows a lorry with a lift-truck secured thereon.

The fork-lift truck consists of a frame 1 provided with front wheels 1 and a pivotable rear wheel 3. To steer the truck the rear wheel 3 can be turned by means of an arm 4 which is also provided with a control 5 for the drive mechanism 6 secured on the frame, and for operating the various fork-lift truck adjustments as will be explained hereinafter. The frame 1 bears a circular-sectioned tubular part 7 provided with a slot. A circular shaft 8 is mounted in the tubular part and is provided with a plate 9 extending through the slot in part 7. In the construction illustrated, a plate 9 and a plate 10 are provided as will be seen from figs. 2 and 3. A mast 11 is secured to the plates 9 and 10 and is slidable and pivotable as a result of the shaft 8 and bearings 7. The sliding movement of the mast is obtained by means of a control cylinder 12 which at one end is secured at 13 to the frame 1 while its other end is secured via a piston rod to a part 14 connected via plate 9 to mast 11. When the cylinder 12 is actuated, the mast can be moved into the broken-line position $11^{1}$ and into the dot-dash position $11^{11}$ as shown in fig. 2. The mast bears a load carrying fork 15 with two fork arms 16 and 17 which are guided in the mast via rollers 18 and can be moved up and down in known manner by means of chains 19 and associated sprocket wheels and a control cylinder 20. The mast 11 has a cam 21 to which a cylinder 22 is secured. The piston rod of cylinder 22 is secured to the arm 23 of a toggle lever 24 pivotally connected to mast 11 at 25. Arm 26 of the toggle lever 24 is pivotally connected at 27 to a slide element 28 guided by rollers 29 in a rail-shaped hollow section 30.

Fig. 5 is an exploded view showing the middle position of the various parts, the mast being in the middle position. Broken lines indicate the various positions of the parts mentioned hereinbefore when the mast is inclined forwardly, while the dot-dash line indicates the position of the parts when the mast is inclined rearwardly. The parts are denoted by the prime sign in the broken-line position and by double prime in the dot-dash position. The drawings show how compact the complete machine can be made in the direction of travel as a result of the construction described, so that the centre of gravity of the entire fork-lift truck is situated within the wheels. There is therefore no need to use counterweights. Fig. 4 also shows the frame 1 provided with an upright stop 31. The other side of the frame is also provided with a stop (not shown) constructed in the same way. The top surface 32 of the stop is substantially oblique. This stop prevents any risk of damage as a result of the fork 15 striking against the wheels 2 on lateral displacement. Since very considerable forces may be exerted, this is a ready means of preventing the wheels being stressed by the fork. For the sake of clarity, the stop 31 is shown in a far forward position, but it will be clear that the closer the stop is to the rear of the frame 1 the smaller movement about the rear of the frame the forces exert. The oblique surface 32 means that any impact can be taken more readily from the side, and also when the mast is in an extreme lateral position the fork in fact can be taken better as it moves downwardly.

Finally, fig. 6 shows a lorry which at the rear has girders 33 extending in the longitudinal direction, into which the arms 16, 17 of the truck according to the invention fit. The fork-lift truck can be disposed behind the lorry and then the fork can be moved upwardly until the fork arms 16, 17 can be introduced into the openings of the box girders 33. If the fork-lift truck is then operated in such a manner that the fork would move downwardly, the frame 1 of the fork-lift truck is pulled against the underside of the lorry. The fork-lift truck can then be secured by means of a cable or chain 34. As a result of the small longitudinal dimensions of the mast with the various controls, the lift-truck can remain within the admissible profile of the lorry.

WHAT WE CLAIM IS:—

1. A fork-lift truck having its own drive mechanism, comprising a frame provided with wheels, a mast disposed on said frame and adapted to tip forwardly and rearwardly, means for tipping the mast, a fork adapted to move up and down along the mast, and means for moving the fork up and down, the mast together with the fork being movable laterally (transversely of the normal direction of travel of the fork-lift truck) over a distance

of at least half the width of the fork, means being provided to produce the lateral movement, said means allowing the tipping movement of the mast, said means for tipping the mast engaging the frame via an element displaceable laterally with respect to the frame.

2. A fork-lift truck according to claim 1 wherein a bearing for the tipping mast is formed by a tubular part which is provided with a continuous slot and which is rigidly connected to the frame, a shaft being mounted in said tubular part and being slidable and rotatable therein and provided with one or more plate-like elements extending outwardly through the slot and bearing the mast.

3. A fork-lift truck according to claim 1 or 2 wherein the means for displacing the mast laterally are formed by a control cylinder one end of which is connected to the frame and the other end to the mast, said cylinder extending substantially parallel to and at a slight distance from the tipping bearing and mounted so as to accommodate the tipping movement.

4. A fork-lift truck according to claims 1 to 3 wherein the means for tipping movement comprise a control cylinder one end of which is connected to the mast and the other end of which is connected to one arm of a toggle lever pivotally connected to the mast, the other arm of the toggle lever being pivotally connected to a slide movable in a guide forming part of the frame.

5. A fork-lift truck according to claim 4 wherein the slide is guided via one or more rollers in a transversely extending section which forms a hollow rail and which is secured to the frame.

6. A fork-lift truck according to claims 1 to 5 wherein the frame girders bearing front wheels may be provided with a stop extending upwardly, the fork striking against said stop on lateral movement of the mast when the fork threatens to come into contact with either of the wheels.

7. A fork-lift truck according to claim 6 wherein the stops have top end faces which are inclined obliquely downwards to engage the fork on either a lateral or a downward displacement.

8. A fork-lift truck substantially as has been described in the accompanying drawings.

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1491422 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

**Sheet 1**

Fig.1

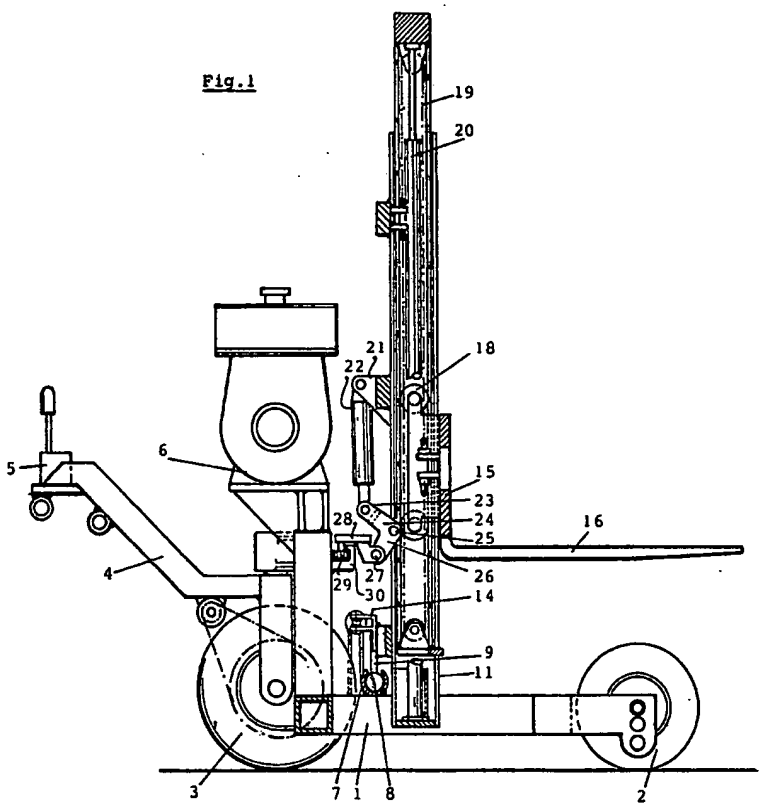

Fig.2.

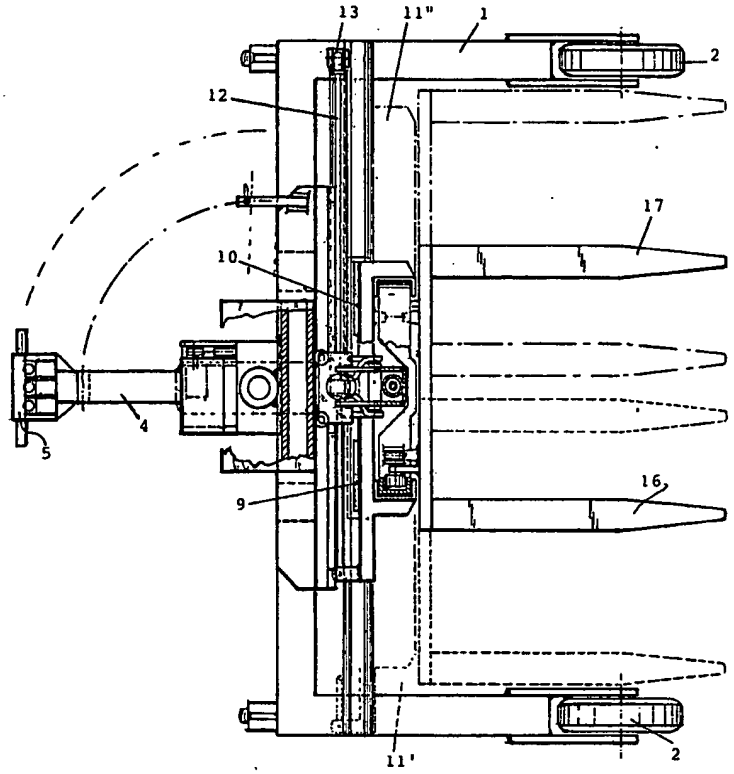

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Fig.3

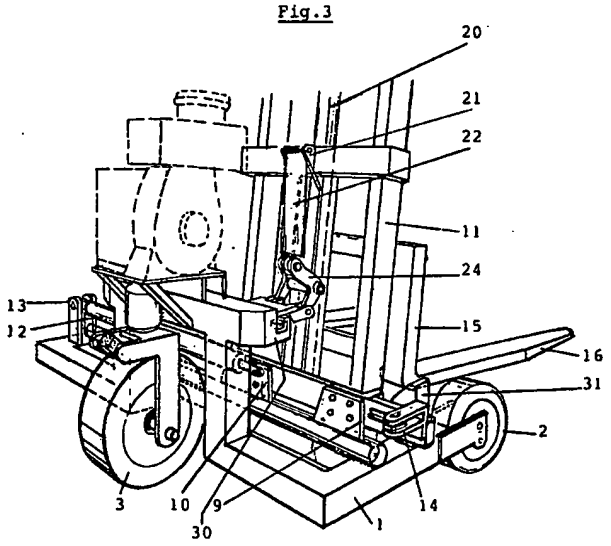
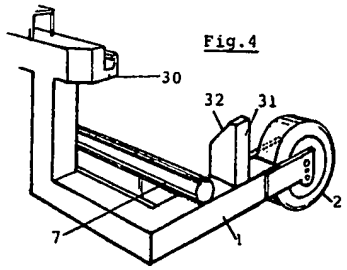



Fig.4



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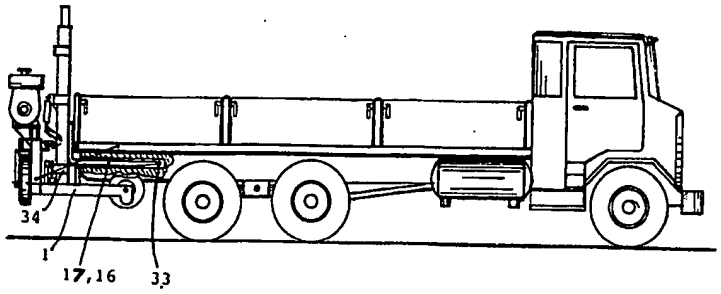
Sheet 4

Fig.6



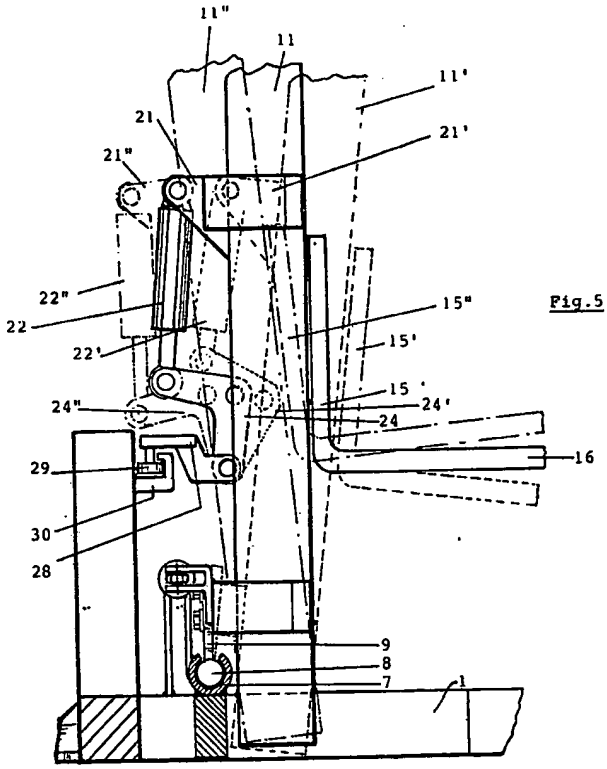




Fig.5